Course Specification

(Postgraduate Programs)

Course Title:	Semiconductor Manufacturing Technology
Course Code:	2202-573
Program:	Master in Electrical Engineering
Department:	Electrical Engineering
College:	College of Engineering
Institution:	King Faisal University
Version:	V2
Last Revision Date:	17 April 2025

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A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐ University	☐ College	☒ Department	☐ Track
B.	☐ Required		☒ Elective	
3. Level/year at which this course is offered: Level 2/1st year				
4. Course General Description:				
This course gives a detailed description of fabrication technologies used in the semiconductor industry; Semiconductor material and device fabrication theory involving its physics and chemistry. Topics include major semiconductor processing techniques: oxidation, diffusion, deposition, etching, photolithography to fabricate metal oxide semiconductor capacitors (MOSCAPs) and field-effect transistors (MOSFETs). Computer modeling of device fabrication; and analysis of device performance. Two classroom-based lectures.				
5. Pre-requirements for this course (if any)**:**				
2202-570 (Advanced Electronics)				
6. Co-requisites for this course (if any)**:**				
None				
7. Course Main Objective(s):				
This class is designed in compliance with the state-of-the-art semiconductor industry's advanced device fabrication. The main objective of this class is to provide knowledge of semiconductor fabrication. This course will teach the key fabrication technologies and the scientific foundations that carried microelectronics well into nanotechnology.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		

No	Mode of Instruction	Contact Hours	Percentage
3	Hybrid ● Traditional classroom ● E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Assignments**	20
3.	**Library**	10
4.	**Projects/Research Essays/Theses**	30
5.	**Others (specify)……**	
	Total	90 Hours

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Identify the engineering processes involved in semiconductor manufacturing	K1	Lectures	Final Exam M.T. Exam HW, QZ
1.2	Select the appropriate physical models for predicting the outcome of semiconductor processes and identify assumptions and constraints.	K1	Lectures	Final Exam M.T. Exam HW, QZ

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.3	Recognize and follow an engineering design process to design a process flow for fabricating a semiconductor device.	K1	Lectures	Final Exam M.T. Exam HW, QZ
1.4	Understand the silicon fabrication processes, their metrologies and related theory	K1	Lectures	Final Exam M.T. Exam HW, QZ
1.5	Learn theory and practical techniques for optical lithography processes	K1	Lectures	Final Exam M.T. Exam HW, QZ
1.6	Identify the challenges and interactions between lithography and all the critical processes	K1	Lectures	Final Exam M.T. Exam HW, QZ
2.0	**Skills**			
2.1	Apply appropriate mathematical techniques to model semiconductor fabrication processes.	S1	Lectures	HWs, Exams, project
2.2	Recognize and follow an engineering design process to design a process flow for fabricating a semiconductor device.	S2	Lectures	HWs, Exams, project
2.3	Use state-of-the-art semiconductor design tools.	S2	Lectures	HWs, Project

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.0	**Values, autonomy, and responsibility**			
3.2	Communicate the design project experience through a detailed report and a short presentation.	V1	Lectures	Project Presentation
3.1	Propose solutions to open-ended problems during the course project focused on designing a process flow for fabricating a semiconductor IC.	V2, V3	Lectures	Project
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	Introduction to Semiconductor Technology, Review of Semiconductor Physics, Semiconductor Device Background Chapter 1	6
2.	CMOS Technology Chapter 2	6
3.	Wafers, Clean-rooms Chapter 3,4	6
4.	Lithography Chapter 5	6
5.	Thermal Oxidation Chapter 6	3
6.	Doping Chapter 7,8	6
7.	Doping/thin films Chapter 7,8, 9	6
8.	Thin film Deposition Chapter 9-12	6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	HW 1	Week 2	2%
2.	Quiz 1	Week 3	5%
3.	HW 2	Week 4	2%
4.	Quiz 2	Week 5	5%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
5.	HW 3	Week 6	2%
6.	Exam1	Week 8	25%
7.	HW 4	Week 10	2%
8.	Quiz 3	Week 12	5%
9.	HW 5	Week 13	2%
10.	Project or research paper	Week 15	20%
11.	Final comprehensive exam	Week 16	30%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	Silicon VLSI Technology", J D Plummer, M D Deal, and P B Griffin, Prentice-Hall, 2000.
Supportive References	1. Introduction to Microelectronic Fabrication: Volume 5 of Modular Series on Solid State Devices", Richard C. Jaeger, second edition, Prentice Hall, 2002. 2. Fabrication Engineering at the Micro and Nanoscale, 3rd Edition, by Stephen A. Campbell, Oxford University Press, 2007 3. VLSI Technology, 2nd Edition, by Sze, McGraw-Hill Education, 2003
Electronic Materials	1. IEEE Xplore 2. NXP semiconductor: www.nxp.com/
Other Learning Materials	Semiconductor simulation tools and Other reading material by the instructor.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom meeting twice a week (1 hour and half each lecture)
Technology equipment (Projector, smart board, software)	Blackboard and BPM software, other simulation software
Other equipment (Depending on the nature of the specialty)	semiconductors demonstration tools

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect: Online Course Evaluation
Effectiveness of students' assessment	Students and Faculty	Direct and Indirect Assessment
Quality of learning resources	Students and Faculty	Indirect- Online Survey
The extent to which CLOs have been achieved	Students and Faculty	Direct: Course Report Presentation Direct: Assessment using student grades Indirect: Assessment of CLOs
Other	None	None

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**EE DEPARTMENT QUALITY COMMITTEE**
REFERENCE NO.	**MEETING # 10**
DATE	**APRIL 19, 2025**